



Women Scientists and Engineers in the 1960's and 1970's at the Marshall Space Flight Center

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During the 1960's, the Marshall Space Flight Center developed the Saturn rockets that would launch the first Americans to the moon. During the 1970's, the Center developed the propulsion elements needed for the Space Shuttle first launched in 1981. During that 20-year period, women scientists and engineers at the Marshall Center contributed to those accomplishments and others. Today, Marshall women hired during that period are still making significant contributions, and they serve as mentors for the women who came to Marshall in the 1980's and 1990's.

An article in the *Marshall Star* on January 11, 1961, stated that "22 scientists and engineers are listed among 43 professionally skilled women at MSFC." **Doris Chandler** and **Sara Corbitt** were among other engineers who contributed to the Center's success during the Apollo/Saturn era. Corbitt was assigned to the Center's Propulsion and Vehicle Engineering Laboratory and studied ways



**Carolyn Griner, Doris Chandler,
Mary Helen Johnston, Ann Whitaker**

to obtain accurate analyses of metals and alloys. **Mary Jo Smith**, a physicist with a degree from Texas Christian University, was assigned to the Center's Research Projects Division to work on plans for the Pegasus meteoroid detection satellite that the Center launched aboard a Saturn rocket in the early 1960's. Only a few months after Marshall was created in 1960, **Laura M. Cheng**, who held a PhD in physics, was reported working in the Center's Aeroballistics Division on research in the high altitude velocity of sound, high-speed gas physics and the transport properties of gases at high temperatures. Another physicist, **Joyce Neighbors**, was working in 1961 in the Advanced Studies Branch of the Center's Guidance and Control Division. **Margaret W.**

"Hap" Brennecke, who had earned a BS from Ohio State University, worked 22 years for a private firm as a research engineer before coming to the Marshall Center as a welding expert. Throughout the Saturn era, she was called on to make decisions on metals and welding techniques. She was also cited for her work with lightweight high-strength materials. Later assigned to the Metallic Materials Division of the Center's Materials and Processes Lab, she worked on the specifications for metals to be used in Spacelab and the Solid Rocket Boosters for the Space Shuttle. By 1964, **Ann McNair** was chief of the Mission Studies Section in Marshall's Aero-Astroynamics Laboratory. McNair's involvement included Saturn flight trajectory studies and determining how long satellites might remain in orbit. Early on, she authored papers on the lifetime of satellites and on comparing onboard and ground tracking for lunar missions.

McNair earned a BS in physics and mathematics from the University of Alabama, Tuscaloosa. **Ethel H. Bauer**, another Marshall Center aerospace engineer, was cited for her contributions to lunar trajectory studies during the Apollo era. A graduate of Huntington College with a degree in mathematics, Bauer worked in the Center's Mission Analysis Section. In 1965, **Ann Whitaker**, who later earned a PhD, was working as a physicist in Marshall's Propulsion and Vehicle Engineering Laboratory. Her work during the Saturn era included studying lubricants and conducting research in surface physics. Part of her research, included a series of high-load friction tests of metal surfaces coated with a dry film lubricant. Whitaker earned a BS in physics and mathematics from Berry College in Rome, Georgia.



Barbara Askins



Ellen Williams

As the Saturn/Apollo era began to close, women at Marshall also provide technical expertise in programs like Earth resources technology.

Lou E. Hall, a mathematician who earned a degree from Tuskegee Institute in 1967, was involved in analyzing Earth Resource Technology Satellite Data. She specialized in hydrology and watershed studies. **Margaret B. Alexander**, and **Barbara R. Facemire**, were assigned to the Center's Space Science Laboratory in the 1970's. Alexander had joined the Marshall Center in 1961 after earning a BS in mathematics from the University of Alabama. As an aerospace engineer in the laboratory's Aerospace Environment Division, she performed professional engineering and scientific studies of problems in fluid dynamics and thermodynamics of the atmosphere. Part of her work included studying turbulence, wind shears, and gusts and their relationship to plans for the Space Shuttle. Facemire, who had earned a BS degree in chemistry from St. Mary's Dominican College in New Orleans began work at the Marshall Center in 1967. She studied the basic properties of materials as part of her assignment in Solid State Physics Division in the Space Sciences Laboratory. During the *Skylab* era, she served as a principal investigator on a science demonstration in liquid diffusion. Facemire was also involved in two science demonstrations conducted as part of the U.S.-Soviet Apollo-Soyuz Test Project mission in 1975.



Dean Russell

During the *Skylab* mission, Marshall's **Dean Russell**, an Auburn graduate with a BS in mathematics, was part of a contamination control team that analyzed changes that occurred in the contamination levels surrounding instruments aboard *Skylab*.

Nancy J. Milly was

employed by the Marshall Center in 1960 after earning a degree in aerospace engineering from Virginia Polytechnic Institute. She began work as a flight systems engineers in the Center's Quality Laboratory. By 1975, she was working as an aerospace engineer analyzing failure mode effects of flight systems.

In 1974, Marshall's **Mary Helen Johnston, Ann Whitaker, Doris Chandler, and Carolyn Griner** served as an all-women crew of scientific experimenters in a five-day, ground-based exercise in Marshall's General Purpose Laboratory, a cylindrical structure designed to approximate the size of Spacelab. The purpose of the exercise was to conduct 11 selected experiments in materials science to determine their practical application for future Spacelab missions.

Carolyn Griner, an astronautical engineer, who now serves as Marshall's Deputy Center Director, was principal investigator for five of the experiments and was co-investigator



Ann McNair

with Johnston on one other. Chandler, another Marshall Center engineer, served as the communication contact between the crew and the "ground station." Later she would serve as a team leader for integrating experiment in the first three Spacelab missions.

Griner and Johnson, engineers assigned to Marshall's Materials and Processes Lab in 1975, were also involved in designing scientific payloads for a series of Marshall Space Processing and Applications Rockets (SPAR) that were launched in the late 1970's and early 1980's. At about the same time, Griner, Johnson and Whitaker completed pressure suit-training to help them understand problems associated with doing experiments in space. The three also completed a training course using scuba gear in Marshall's Neutral Buoyancy Simulator, a huge water tank designed for engineers and others to simulate the near weightless environment of space.

They were among other women engineers at Marshall during the mid-1970's who were involved in simulation studies related to plans for the Space Shuttle. **Alberta King**, employed by the Marshall Center in 1961, later studied how a space tug might rendezvous with the Shuttle. King had earned a BS in mathematics and an MS in industrial engineering from the University of Alabama in Huntsville. King also served as a member of the team

involved in controlling *Skylab* during its reentry into the atmosphere in the late 1970's.

During the late 1970's and early 1980's, the Marshall Center also launched three High Energy Astronomy Observatories (HEAO) designed to study the new field of high-energy astrophysics. Part of the management team for that project included Marshall's **Joyce Neighbors**, who served as a senior systems engineer for HEAO, and was responsible for the thermal, structural, and dynamic design of the three observatories. Neighbors, who later earned a PhD in engineering mechanics from the University of Alabama, Tuscaloosa, held a BS degree in mathematics from Auburn, and an MS degree in engineering mechanics from the University of Alabama.

In 1977, as plans for the Space Shuttle moved closer to reality, **Mary Boulton**, who originally joined the Marshall Center in April 1964, was using digital and differential



Mary Boulton

analyzer computers to perform studies on how the solid rocket boosters and external tank might perform after they were released from the Space Shuttle. Earlier in her career, Boulton, who earned a BS degree in math and physical science from Bethal College in McKenzie, Tennessee, had worked at Marshall on lunar orbit studies and performed control systems analysis for the Saturn IV and Saturn V launch vehicle as well as the Lunar Roving Vehicle and *Skylab*.

In the mid-1970's, **Miriam S. Hopkins**, who had come to the Marshall Center in 1960's, was also working on plans for the Space Shuttle. As an aerospace engineer, she studied the reentry dynamics for the Space Shuttle external tank. Hopkins had earned a BS degree in physics and math from the University of Southern Mississippi at Hattiesburg.

Women engineers at Marshall were also recognized for their work by professional groups outside of NASA. Barbara S. Askins, a chemist in the Astronomy Branch of Marshall's Space Sciences Laboratory, was named National Inventor of the Year in 1978. Askins invented an improved method for intensifying the image on photographic films and plates after they were developed.

In the 1970's Marshall's broadened its involvement in space science with projects like the Gravitational Redshift Probe (GP-A), Laser Geodynamic Satellite (LAGEOS), and Large Space Telescope, later renamed the Hubble Space Telescope. One of the engineers involved in those projects was **Anne B. Folsom**, who served as lead engineer for the Reliability and Quality Assurance Office in Marshall's Science and Engineering Directorate. Folsom, had earned a degree in mathematics and history at the University of Mississippi and went to work as an instructor in radar systems at Keesler Air Force Base. Later, she joined the Army Ballistic Missile Agency in Huntsville and transferred to the Marshall Center when it was formed in 1960.

Patricia D. Brandon had also transferred to the Marshall Center from the Army Ballistic Missile Agency after earning a BS degree in mathematics from the University of Chattanooga. During the Saturn era, she worked as an aerospace engineer in the development of guidance systems. As the era of the Shuttle approached the late 1970's, she produced computerized math models in support of Spacelab ground and flight operations. Later, she began work in the Mass Properties group in the Systems Analysis and Integration Laboratory.

Jeanette F. Reisz, a mathematician at Marshall, was also involved in computer applications. Reisz was assigned to the Navigation and Control Systems Branch in Marshall's Preliminary Design Office in Program Development. Her work included computer programming of spacecraft advanced guidance, navigation, and control systems. Reisz had earned a BS in mathematics from Delta State College in Cleveland, Mississippi.

Jeanette A. Scissum joined the Marshall Center in 1964 after earning a degree in mathematics from Alabama A&M University. In the mid-1970's she was working as a space scientist in the Space Environment Branch of the Center's Space Sciences Laboratory developing space environment models from which predictions could be made on the life expectancy of satellites.

Physicist **Mona Hagyard**, who earned a PhD, also served as an expert in space science and was a principal investigator on the Solar Maximum Mission in the 1980's. She came to MSFC in September 1967 upon completion



Mona Hagyard

She came to MSFC in September 1967 upon completion

of her PhD in physics at the University of Kentucky. She joined the Research Projects Laboratory (now Space Sciences Laboratory) to work on the Apollo Telescope Mount (ATM) solar experiments. Shortly after joining MSFC, she became involved in the MSFC Solar Vector Magnetograph project which was started in conjunction with the Naval Research Laboratory to provide support for the ATM mission. This instrument became internationally recognized during the Solar Maximum Mission era and has provided pioneering research in solar magnetic fields. Dr. Hagyard was a Guest Investigator for the Solar Maximum Mission, for the Compton Gamma Ray Observatory, and principal investigator on a number of Supporting Research and Technology grants and Center Director's Discretionary Fund programs. In 1980 she became Team Leader of the MSFC Solar Observatory, directing the day-to-day operations of the Observatory. Her main areas of research include the interpretation and analysis of solar vector magnetograph data, radiative transfer in magnetic fields, modeling of solar magnetic fields, and investigations of the role of magnetic fields in various manifestations of solar activity.

Ellen M. Williams, who earned a degree in mathematics from the University of Alabama, Tuscaloosa, worked in the mid-1970's in the Computer Systems Branch of the Huntsville Computer Complex.

Frances E. Scott, a biologist at Marshall, had started her career in government as a secretary at the Center. She eventually earned a BS degree in biology from Athens College in Athens, Alabama. Later she served as a biologist in the Biotechnology Branch of Marshall's Materials and Processes Laboratory. She was a specialist in sterilization methods for planetary quarantine and as an investigator for the red blood cell portion of an Electrophoresis experiment conducted during the Apollo-Soyuz Test Project in 1975.



Sally Little

By the late 1970's, Marshall's women scientists and engineers were involved in activities that took them outside the laboratory walls. **Sally Little**, who had earned a BS degree in engineering science and mechanics from the University of Tennessee, worked as an engineer in Marshall's Materials and Processes Laboratory. Part of her work, however, included experiencing momentary near-weightlessness during flights of a NASA KC-135 aircraft. The experience was designed to test the loading and dispensing activity of apparatus for a Spacelab experiment.

As Marshall moved into the Space Shuttle era, many of its women engineers and scientists would move into high profile activities, most notably Marshall engineer **Jan Davis** who was selected as a NASA astronaut in the late 1980's.

To Learn More

You can learn more about the history of Marshall Space Flight Center on the World Wide Web.

<http://history.msfc.nasa.gov>



Jeanette Scissum